

**PAGELMIS AMAZONICA, A NEW GENUS AND SPECIES OF
WATER BEETLE FROM ECUADOR
(COLEOPTERA: ELMIDAE)**

PAUL J. SPANGLER

Dept. of Entomology, Smithsonian Institution,
Washington, D. C. 20560

The new genus of riffle beetle described here was found among the very rich and interesting collections of aquatic insects made during the Ecuador-Peace Corps-Smithsonian Institution Aquatic Insect Survey of Ecuador that was conducted from 1975 through 1979. Specimens of this new genus were very abundant in catches in blacklight traps. The large number of specimens (6,000+) and the unusual and extensive plastron drew attention to this beetle and resulted in its description here. All specimens I have seen of this species—except for parts of the legs, head and its appendages, and a narrow area on the pronotum and on the elytra—are covered with a plastron. Other elmids, with few exceptions, have a plastron restricted to the ventral surfaces. Scanning electron micrographs provided visual evidence of the structure of the plastron of this new taxon and suggested a possible manner by which the plastron may be formed; following the descriptions of the new taxa, the plastron and other features of the cuticular ultrasculpture are discussed.

Pagelmis, new genus

Body elongate, subparallel, and moderately convex (Fig. 1). Integument with an opaque plastron which apparently covers body except head, eyes, antennae, mouthparts, middle of mesosternum, metasternum between middle coxae, a narrow medial area on basal two-thirds (Fig. 2) of pronotum, scutellum, and a band four times wider at base than at apex and paralleling elytral suture (Fig. 1).

Head when seen from below partly retracted into pronotum; dorsal surface partially hidden by anterior prolongation of pronotum. Mouthparts visible. Maxillary palpus 4 segmented. Labial palpus 3 segmented. Antenna 11 segmented, arising beside inner edge of eye and separated from clypeus by a deep transverse groove. Labrum rather broad and transversely rectangular.

Pronotum (Fig. 2) widest at basal one-third then narrowing anteriorly, becoming evenly arcuate over head, rimmed apicomediaally, also narrow-

ingly slightly posterolaterally; posterolateral angles moderately acute; posterior margin bisinuate; carinae absent. Elytra with first row of punctures distinct, laterally other rows become increasingly effaced; carinae absent; humeri slightly swollen. Prosternum long in front of forecoxae; prosternal process slender, moderately elongate (Fig. 5), parallel sided and bordered by a distinct rim, apex bluntly rounded. Mesosternum deeply depressed on midline in front of and between anterior half of mesocoxae for reception of prosternal process. Metasternum between mesocoxae without opaque plastron, remainder with opaque plastron; disc with narrow, longitudinal, shallow, posterior depression on midline. Legs with visible portion of front coxae rounded and trochantin concealed by hypomera. Protibiae, mesotibiae, and metatibiae without cleaning fringes. Hind trochanters of male each with a strong tubercle apicoventrally (Fig. 7). Claws small, slender, without teeth.

Abdominal sterna 1–5 normally convex and not lobed laterally.

Type-species of the genus.—*Pagelmis amazonica*, new species.

Etymology.—*Pagelmis* from pago, G.—frost, in reference to the opaque, frostlike appearance of the plastron covering much of the pronotum, elytra, and venter; plus elmis from the nominate genus of the family, *Elmis*. Gender: feminine.

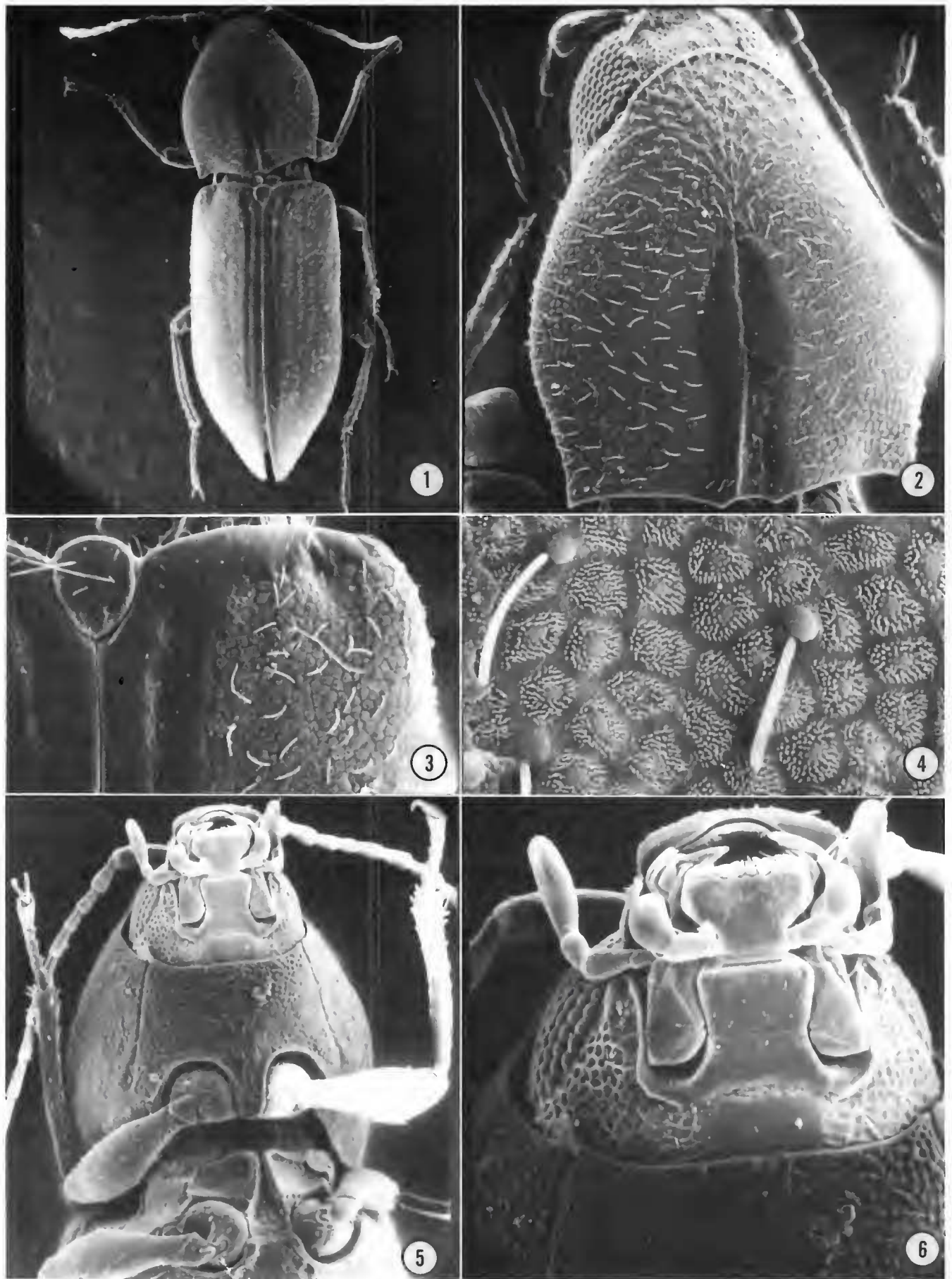
Comparative notes.—This new genus, because the dorsal surface of the integument is mostly opaque as described above, resembles a miniature *Stenhelmoides* but may be distinguished by the following combination of characters: prosternal process parallel sided and narrow, about a third as wide as long (Fig. 5); hind trochanter of males each with an apicoventral tubercle (Fig. 7); all tibiae without cleaning fringes (Figs. 7, 8).

***Pagelmis amazonica*, new species**

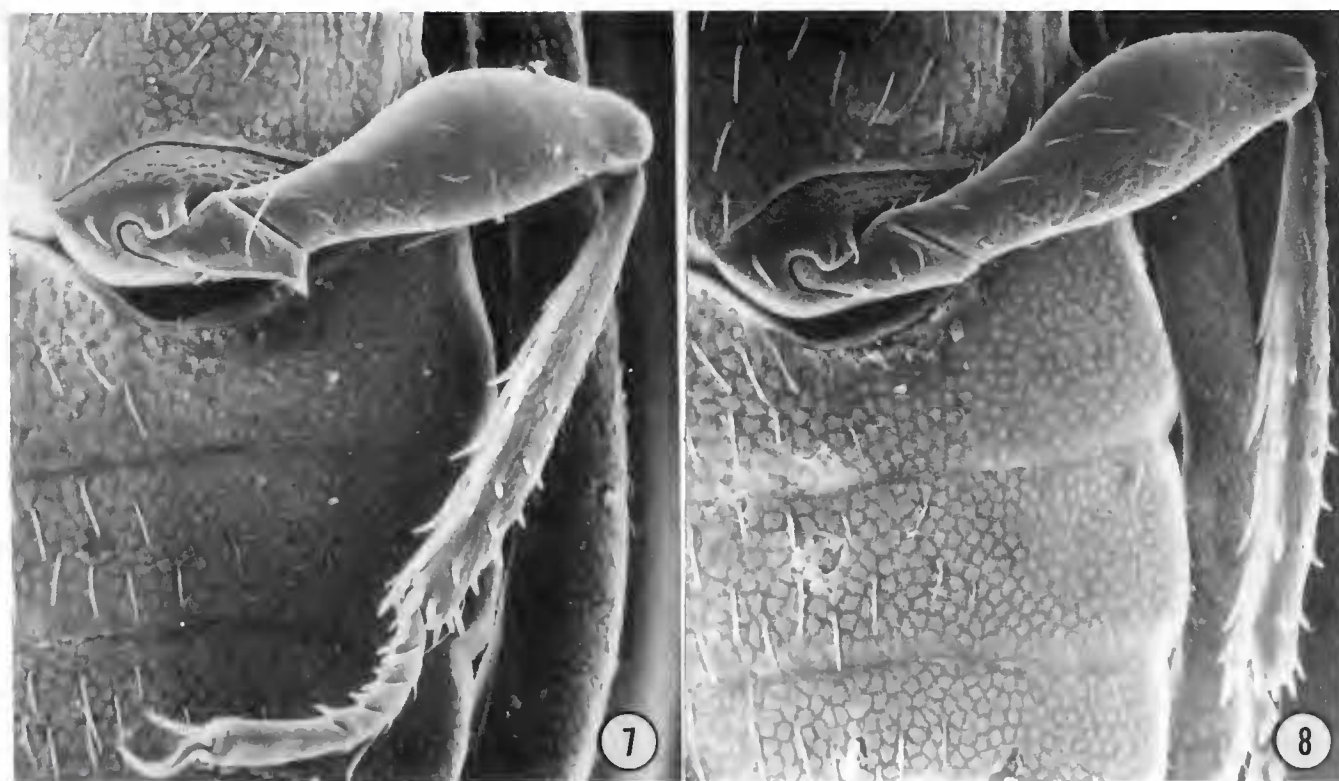
(Figs. 1–17)

Holotype male.—Form and size.—Body form elongate, subparallel, and moderately convex (Fig. 1); length 2.2 mm; width 0.8 mm.

Coloration.—Plastron covers integument except those areas listed under generic description. Also, dorsum with contrasting, shiny, narrow, sinuous, microalutaceous, longitudinal area on midline of posterior half of pronotum and a similarly shiny contrasting area on each elytron. Shiny area of elytron a narrow band across base and a wider band along suture; shiny band narrows at apical fourth of elytron. Head and pronotum reddish brown but color obscured by opaque plastron. Pronotum with short, sparse, golden setae. Elytra reddish brown except each elytron with 1 basal and 1 subapical dark brown macula; maculae joined by a dark, poorly defined, subsutural stripe; coloration obscured by plastron. Elytra with short, sparse, golden setae on indistinct intervals.



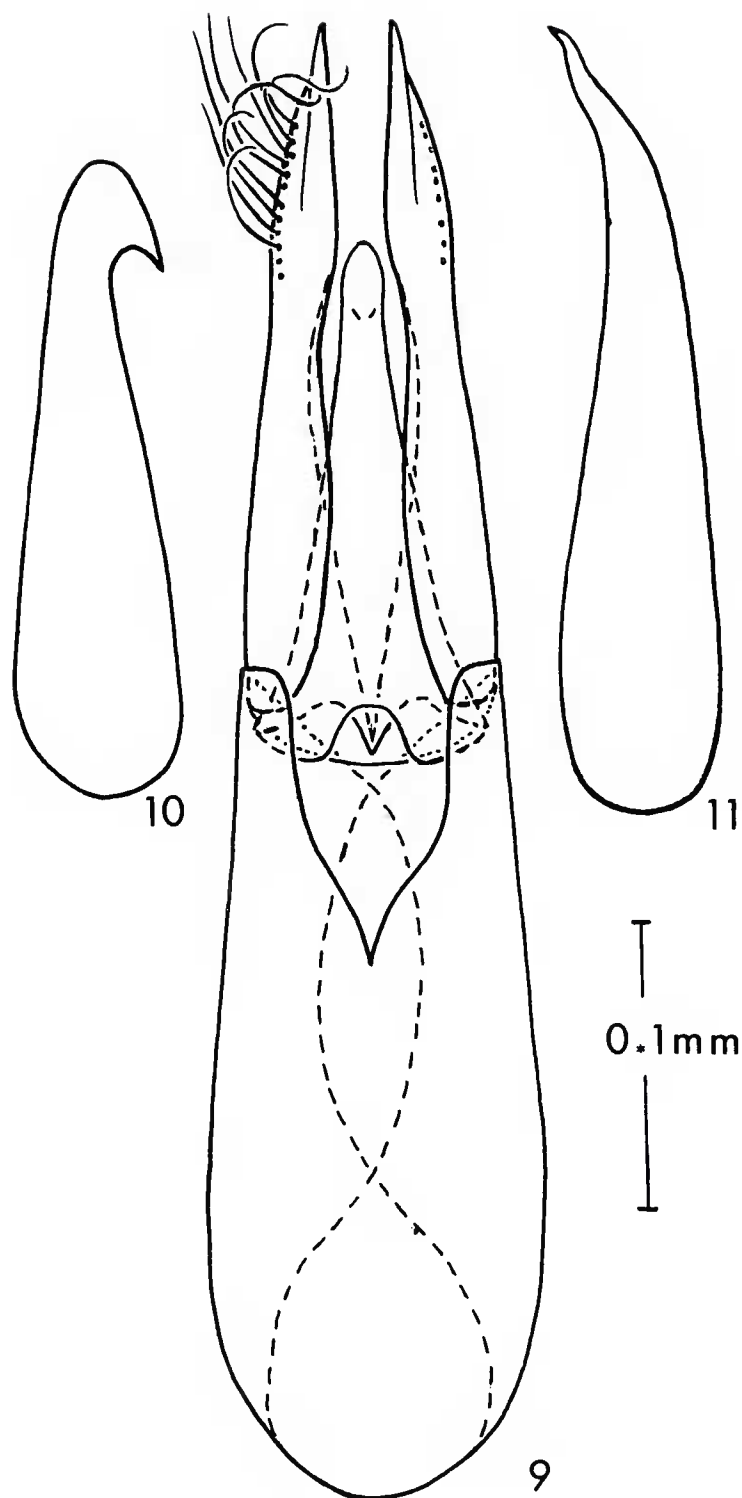
Figs. 1-6. *Pagelmis amazonica*, n. gen., n. sp.: Fig. 1, habitus view, 44 \times . Fig. 2, pronotum, 140 \times . Fig. 3, base of elytron, 220 \times . Fig. 4, plastron on base of elytron, 1100 \times . Fig. 5, prosternum, 100 \times . Fig. 6, head, ventral surface, 230 \times . Photographs reduced $\frac{1}{3}$.



Figs. 7-8. *Pagelmis amazonica*, n. gen., n. sp.: Fig. 7, hind leg, male, 160 \times . Fig. 8, hind leg, female, 160 \times . Photographs reduced $\frac{1}{6}$.

Head.—Partly retracted into pronotum (Figs. 5, 6). Mouthparts visible. Maxillary palpus 4 segmented (Fig. 6). Labial palpus 3 segmented. Antenna 11 segmented, arising beside inner edge of eye and separated from clypeus by a deep transverse groove. Labrum rather broad, transversely rectangular, and coarsely punctate.

Thorax.—Pronotum widest at basal third, converging anteriorly and extending apicomediaally over base of head; narrowing slightly posterolaterally; sides strongly, evenly arcuate; base shallowly bisinuate; posterolateral angles moderately acute; integument impunctate but small sparse granules basally and numerous coarser granules on anterior third; apicomedial margin arcuate and distinctly rimmed on medial third; carinae absent. Prosternum with coarse granules; long in front of forecoxae; prosternal process slender, moderately elongate (Fig. 5), about 3 times as long as wide, parallel sided and bordered by a distinct rim, apex bluntly rounded. Mesosternum deeply depressed on midline in front of and between anterior halves of mesocoxae for reception of prosternal process. Metasternum with opaque plastron except area between mesocoxae without plastron; disc with narrow, longitudinal, shallow depression posteriorly on midline. Elytron with first (sutural) row of punctures coarse, punctures separated by 1 to 2 times their width; other rows of elytral punctures indicated but indistinct, becoming increasingly effaced laterally. Legs with visible portion of front coxae rounded and trochantin concealed by hypomera. Protibiae, mesotibiae, and metatibiae



Figs. 9–11. *Pagelmis amazonia*, n. gen., n. sp.: Fig. 9, male genitalia, ventral view. Fig. 10, median lobe, lateral view. Fig. 11, paramere, lateral view.

without cleaning fringes (Figs. 7, 8). Hind trochanter with a strong tubercle apicoventrally (Fig. 7). Claws small, slender, without teeth (Fig. 7).

Abdomen.—Abdominal sterna 1–5 normally convex and not lobed laterally.

Male genitalia.—As illustrated (Figs. 9–11).

Female.—Similar to male except the tubercles on the hind trochanters are much smaller than those on the male (Fig. 8).

Variations.—The type-material was obtained from blacklight traps which typically contain many teneral specimens; many of these specimens are lightly pigmented and the elytral maculae are indistinct. In the more darkly pigmented specimens, the prosternum, mesosternum, and metasternum instead of being uniformly reddish brown, have the discal areas darker reddish brown. These color differences are more obvious on specimens in liquid preservatives.

Type-data.—Holotype male and allotype: ECUADOR: Pastaza Province, Tzapino (1°11'S, 77°14'W) (Tigueno, 32 km northeast), 400 m elev., 22 May 1976, Jeffrey Cohen, Ecuador, Peace Corps, Smithsonian Institution Aquatic Insect Survey. USNM Type No. 75669, deposited in the National Museum of Natural History, Smithsonian Institution. Paratypes: Same data as holotype, 6,000 specimens; same data as holotype except 24 May 1976, 19 specimens and 25 May 1976, 10 specimens. Napo Province: Limoncocha, 3 June 1977, W. E. Steiner, 24 specimens; Limoncocha, 8 June 1977, W. E. Steiner, 8 specimens; Limoncocha, 5 June 1977, P. J. Spangler and D. R. Givens, 11 specimens; Limoncocha, 15 June 1977, P. J. Spangler and D. R. Givens, 26 specimens; Limoncocha, 16 June 1977, P. J. Spangler and D. R. Givens, 49 specimens; Puerto Montufar, 26 April 1976, J. Cohen, 6 specimens.

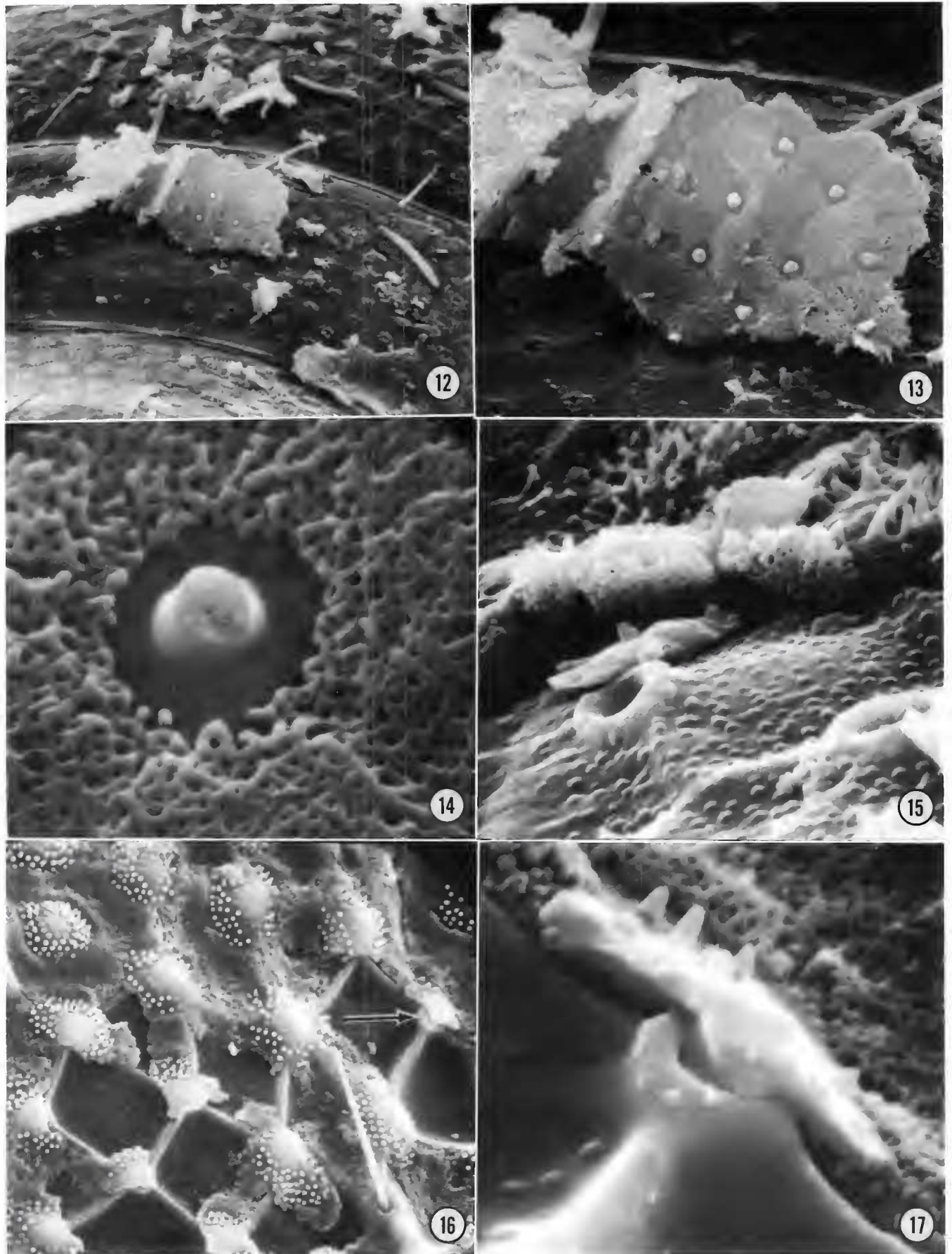
Paratypes will be deposited in the American Museum of Natural History, New York; British Museum (Natural History), London; California Academy of Sciences, San Francisco; Canadian National Collection, Ottawa; Instituto Lillo, Tucuman; Institut Royal de Histoire Naturelle de Belgique, Bruxelles; Museum of Comparative Zoology, Cambridge; Museum Nacional de Historia Natural de Chile, Santiago; Museum National de Histoire Naturelle, Paris; Museo Argentina de Ciencias Naturales, Buenos Aires; Zoologische Sammlung Bayerischen Staates, München; and the Stovall Museum of Science and History, University of Oklahoma, Norman.

Etymology.—*amazonica*, in reference to the occurrence of this taxon in the Amazon River Basin.

Habitat.—Unknown; all material was collected in blacklight traps.

Plastron

Elmid beetles that live in aquatic habitats with a high calcium content often are found to be heavily coated with calcium carbonate; however, those coatings occur irregularly on many areas of the body. The glazed, frosted, or opaque areas covering most of the integument of *Pagelmis*, when examined under a stereoscopic microscope, resembled the calcareous coatings. However, these opaque areas were consistently present in a symmetrical pattern and suggested a non-calcareous cuticular sculpture which probably was produced when the pupa changed into the adult form. Never-



Figs. 12-17. *Pagelmis amazonica*, n. gen., n. sp.: Fig. 12, plastron (scraped loose) of abdominal sterna, 600 \times . Fig. 13, plastron showing plugs from pores in cuticle, 1500 \times . Fig. 14, plug and plastron texture, 12,500 \times . Fig. 15, pore, cuticular microtubercles, and porous plastron, 6000 \times . Fig. 16, cuticular surface of prosternum with broken plastron, 1625 \times . Fig. 17, pore and cuticle, enlarged, seen (arrow) in Figure 16, 11,500 \times . Photographs reduced $\frac{1}{3}$.

theless, I placed some beetles in acetic acid and in a sonic cleaner in an effort to remove the opaque areas, but neither treatment altered the surface sculpture. Subsequently, I scratched the opaque area on the abdomen of a specimen with a pin and then examined the beetle with the scanning electron microscope.

Instead of a plastron made up of a dense layer of often overlapping scale-like setae that I expected to find, and as illustrated for some species in the elmid genera *Austrolimnius*, *Cylloepus*, *Elmis*, *Elsianus*, *Hexacylloepus*, *Limnius*, *Pilielmis*, *Portelmis*, *Stegoelmis*, and *Tyletelmis* by Hinton (1976), it appeared that the plastron of *Pagelmis* is similar to the plastron of members of the aquatic weevil genus *Neochetina* as illustrated and discussed by Hinton (1976). However, the plastron of *Neochetina* is divided into porous scale-like plates supported on microtubercles and the plastron of *Pagelmis* is a porous sheetlike layer supported by microtubercles.

By good fortune, pieces of the plastron that I disrupted with the pin were turned upside down but remained on the specimen examined under the SEM. From this specimen it is evident that in *Pagelmis* the true cuticle (Figs. 3, 12, 13) is relatively smooth and apparently well sclerotized. However, pore-like openings (Figs. 12, 13, 15–17) in the cuticle and cast-like impressions on the lower side of the plastron (Figs. 12–14) suggest that the plastron (Figs. 13–17) probably resulted from secretions exuded from the pores; the micrographs also show that the plastron is porous (Figs. 15, 17). The micrographs show that the plastron rests on microtubercles on the true cuticle and this presumably leaves a thin air space under the plastron and this air space extends into the porous areas in the plastron. In addition, the microcarinae (Fig. 17) radiating from the pores also would support the plastron above the air space.

Because the plastron is distributed more extensively over the ingement, specimens of *Pagelmis* presumably have a larger supply of air available for respiration than do elmids with a reduced plastron. This seems to be an unusual condition because most elmids of the same small size as *Pagelmis* have only a ventral plastron. These small elmids with the smaller, ventral plastron are known to occur in streams and brooks with high to moderate oxygen content; but, unfortunately, the habitat of *Pagelmis* is unknown because all available specimens came from lighttrap collections. It is possible that specimens of *Pagelmis* occur in slow-moving streams or similar habitats which may be low in dissolved oxygen. This suggestion is further supported by the topography and low elevation of the areas from which the type-material was collected. The meandering streams in those areas generally have a low gradient, are more sluggish, and, consequently, contain less oxygen. Under these conditions it seems reasonable that a more extensive plastron would be advantageous and may have evolved in *Pagelmis*. Specimens described in the genus *Stenhelmoides* have a similar glazed,

frosty, or opaque appearance on the venter and extensively on the elytra as well. Unfortunately the habitat of members of this genus also are unknown, but they have been collected in the same localities as the type-material of *Pagelmis*. The plastron on *Stenhelmoides* as seen under the SEM after it has been scraped loose is similar to that illustrated here for *Pagelmis*; the plastron on *Stenhelmoides* will be discussed in greater detail in a revision of *Stenhelmoides* that is in progress.

Acknowledgments

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Literature Cited

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